Provincial Energy Management Program
Year End Report on Progress
Fiscal Year 89/90

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For

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Summary

The Energy Branch of DNRE initiated the **Provincial Energy Management Program** in August of 1988, with the primary goal of improving the use of energy in provincially owned buildings.

The findings in this report marks the completion of the Setup Phase. The resulting energy profile **reveals a total recorded consumption of 787 million kWh at a cost of 33 million dollars, in 1,041 facilities.**

From the analyses of energy intensity levels the **potential for improved efficiency has been determined to be 95 million kWh or 3.7 million dollars annually**. Of this, 28 million kWh or 1.1 million dollars could be saved by simply providing building managers with the knowledge of the available energy efficiency opportunities. Start up of the Energy Audit Phase will help to provide the needed facts, however, without additional funding its overall effectiveness is minimal. Under current funding the maximum audit load is 25 per year.

A normalized billing system was developed between N.B. Power and Supply and Services. The electric bill for all buildings is equalized thereby allowing for a single predetermined monthly payment. This eliminates the monthly invoicing procedure that currently takes place for each building. At year end an +/- adjustment is made. This service will be made available to all departments. Although it is difficult to place a dollar value on the savings, it is obvious that significant benefits will result. **The number of invoices being processed in one year could be reduced from some 12,000 to 20 if every department were to participate.**

The energy profiles have also uncovered a significant variation in the price paid for a litre of light oil. This is due to the fact that several different tenders are issued for its purchase. Assuming that a central tendering process would yield the current lowest cost, the **annual saving would be in the order of $600,000.** The logistics of setting up a mechanism for central tendering of oil will be determined in the course of continued activity.

Based on past experience in measuring the combustion efficiency of oil fired units and statistics generated from over 2000 N.B. energy audits, it is apparent that a significant potential exists. Assuming a conservative 2% increase, **the annual savings for implementing a combustion efficiency program would be 9.5 million kWh or 900,000 litres which is equivalent to $165,000.** Such a program would be relatively inexpensive to deliver.

Savings generated to date amounts to $202,000 with continued associated annual savings of $86,200. This was the result of the discovery of electric rate code errors. Buildings currently under review should result in a further $100,000 saving.

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1.0 Introduction

This report is intended to provide an overview of the **Provincial Energy Management Program** and to summarize work that has been completed to the end of March 31, 1990.

The primary objective of the program is to set up and administer an energy management program for all government owned buildings. It was initiated in August of 1988 with an annual budget of $50,000. Substantial dollar savings have already been incurred as a result of the program and a significant potential exists for further savings.

Section 2.0 of the report provides a review of the program phases and their current status. The results of the Setup Phase, which, follows in Section 3.0 portrays current energy consumption patterns and the potential for efficiency improvement. The last section includes plans for 90/91 and concluding remarks.

2.0 Energy Management Program Portrait

2.1 Program Objectives

The primary goal is to improve the use of energy in provincially owned buildings and to document the associated cost savings. A list of major objectives are as follows;

- Increase energy efficiency.
- Document dollar and energy savings as a result of improved efficiency.
- Improve public awareness.
- Reduce emissions levels.
- Reduce shock effect of increased energy prices.

With the measured success of an energy management program in the public sector the attitudes of the private sector will be enhanced towards placing increased emphasis on energy efficiency. A large portion of the potential for efficiency improvements are those that simply stated, are just good investments. Perhaps some of the scepticism associated with energy efficiency can be dissolved.

On a larger scale, increasing efficiency will reduce the amount of harmful emission which ultimately provides for a safer environment. Efficiency is unquestionably one of the cheapest ways in which to reduce existing emission levels. It has now become the philosophy of many of the U.S. States to practice energy demand reduction as opposed to increasing energy supply. Studies elsewhere have indicated that a dollar spent on efficiency improvement has a higher rate of return than one spent on an energy producing plant.

An energy management program can be justified equally on a monetary basis or as a method to reduce emissions. The effect of accomplishing both of these tasks at the same time lends even greater desire to meet the objectives of the program.

Another significant benefit is the reduction of any possible shock wave effect that increased prices might bring.

It is important to note that the province is by no means ignoring energy management, some very successful programs are in existence at regional levels,

however, none are in place at a departmental level and certainly none exist at a provincial level. The intent of this program is to merge the existing ones into the proposed new framework, lending them credibility, and to initiate the development of an energy management system to incorporate buildings that are not presently being addressed.

2.2 Program Structure

The necessary ingredients for a Provincial Energy Management Program are essentially the same as those for any management program. They include the support of upper management, monitoring and evaluation, goal setting, and the involvement of all people who affect usage. Figure 1.0 illustrates the steps required to set up and implement an energy management program.

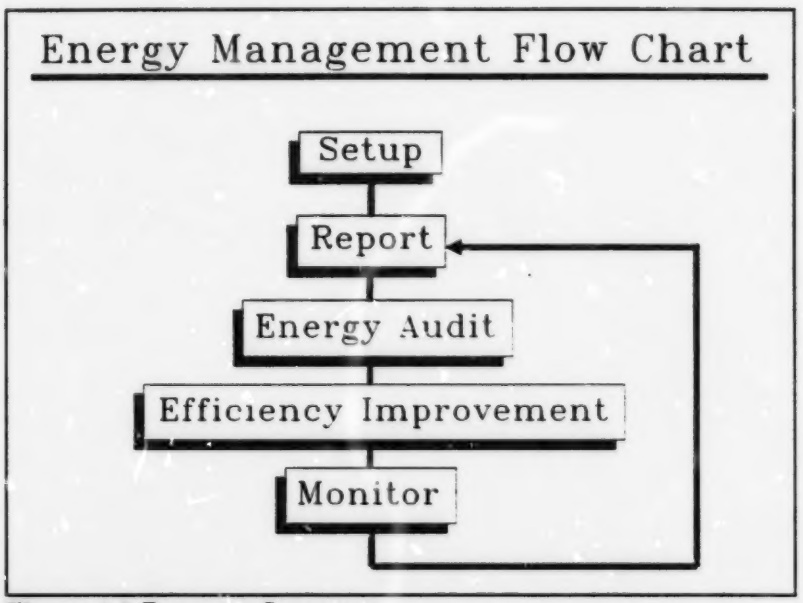

Figure 1.0 Program Structure

The Setup Phase is a one time process that is required in order to establish the monitoring aspect of the program. It also serves to provide initial evaluation of the program potential. Primarily it involves the collection of energy consumption data from all of the provincially owned buildings. As the data is collected it is entered into a computer program which is used to track energy usage. Energy consumption information for the F.Y. 87/88 is being used as the base year for comparison. Work on this phase is complete.

The Reporting Phase represents the mechanism of disseminating information to building managers with respect to energy performance. Annual reports will be prepared indicating the dollars and energy avoided through improved energy efficiency. The initial report is somewhat different as there is no year to year consumption comparisons. It consists of section 2.0 and 3.0 of this document along with an additional section specific to each department, which profiles energy use, identifies potential benefits, and highlights energy intensive buildings. Newsletters on success stories and new developments will be issued as needed. Work is currently in progress on this phase with reports completed for Education, Supply and Services and Transportation. Expected completion for all departments is June, 1990.

Although the evaluation of user efficiency can pinpoint buildings that are in need of improvements, it certainly cannot define the building's problem. The objective of the Energy Audit Phase is, therefore, to identify the problem so that a solution can be formulated. The audit is a systematic approach of defining the current energy situation and identifying the potential energy efficiency opportunities that exist. Once the audit is completed priorities can be set by calculating the payback periods for each respective measure. The audit becomes an essential tool in formulating an efficiency improvement plan. The Energy Branch has in-house expertise to do audits, however, with the existing level of budget and personnel only a limited number can be scheduled. One audit has been offered in each district of the respective departments. Work on this phase will commence in the summer of 1990.

The Efficiency Improvement Phase involves the actual implementation of the efficiency measures and is the responsibility of each department or district. Given the information from the previous phases the energy manager should be in a position to make an informed decision. It is the role of this program to provide the support and motivation needed to assist in the process of implementation. This could involve the development of incentive programs which have proven to work in other jurisdictions. The net cost of such incentive programs would at most be zero and likely a net benefit would be produced.

The Monitoring Phase represents the ongoing collection and evaluation of energy use, with the purpose of measuring the success of the program. Success is measured in primary terms of avoided energy use and dollars spent. Monitoring also offers many other features such as, discovering billing errors, evaluating electric rate

code changes, highlighting abnormal monthly consumption, budgeting, and the preparation of energy related reports. The FASER Energy Accounting Software is the choice package for monitoring. Initially, energy data will be collected on an annual basis, however, as the user structure becomes better defined a monthly collection system will be adopted. Requests for energy consumption data for 88/89 and 89/90 are being made in conjunction with the release of the initial departmental reports on energy. This information will be processed as it is received. With the current level of funding the Monitoring Phase is the primary area of activity.

Energy management is by no means a process that concludes itself. The program is ongoing as long as the province is consuming and new technologies are being discovered.

3.0 Provincial Energy Use

The information to follow represents the results of the Setup Phase. It is inclusive of provincially owned and operated facilities. Unfortunately, it does not include every facility. It is difficult for a survey of a voluntary nature to be all-encompassing. Approximately 95% of all buildings are represented. Rental spaces, Agencies, and Corporations are excluded.

From the data collected, the total recorded energy use in 1,041 facilities amounts to **787 million kWh** at a cost of **33 million dollars**. An additional amount of 12 million dollars can be attributed to fuel use in provincially owned vehicles. The total energy cost for the Province is, therefore, at least 45 million dollars. Given that some information is missing, the actual amount spent is expected to be closer to 50 million dollars.

Throughout the report energy is expressed in either dollars or kiloWatt hours (kWh). It is important to note that the unit kWh does not specifically refer to electricity, but, to all fuels as a common unit of energy used for comparison purposes. Assumptions used in converting fuel amounts to kWh, (see Appendix) account for the associated fuel inefficiencies.

3.1 Energy Consumption Patterns

Figure 2.0 on the following page illustrates the distribution of energy consumption by department in both kWh and dollars. The right side of the horizontal chart depicts dollars and the left side kWh. The acronyms used to represent each department are the same as those used in the Government of New Brunswick telephone directory (see Appendix).

In terms of energy, i.e. kWh, the department of Health and Community Services (HCS) is the largest user with the Department of Education (E) not far behind. These two departments account for 80% of the total use. In looking at the dollar side of the chart an interesting observation can be made. The Department of Education represents a larger portion in terms of dollars than Health & Community Services. This is a result of two basic differences, building sizes and fuels used.

Larger buildings such as hospitals consume more energy, which generally effects a lower average fuel cost. On the other hand, Education uses proportionally more electricity, which has the opposite effect, resulting in a higher average fuel cost.

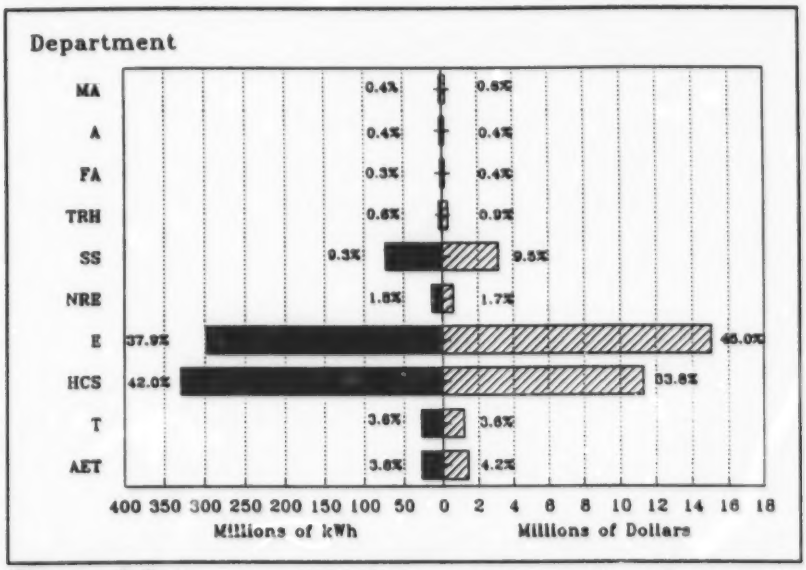

Figure 2.0 Departmental Energy Consumption Patterns in Both kWh and Dollars, Fiscal Year 87/88.

Figure 3.0 displays the proportional use of the various types of fuels. It illustrates the dramatic affect of fuel costs on a per kWh basis. For example heavy oil accounts for 19% of total energy used while on the other hand only 9% of the total cost. Propane use is negligible and is excluded from the figure.

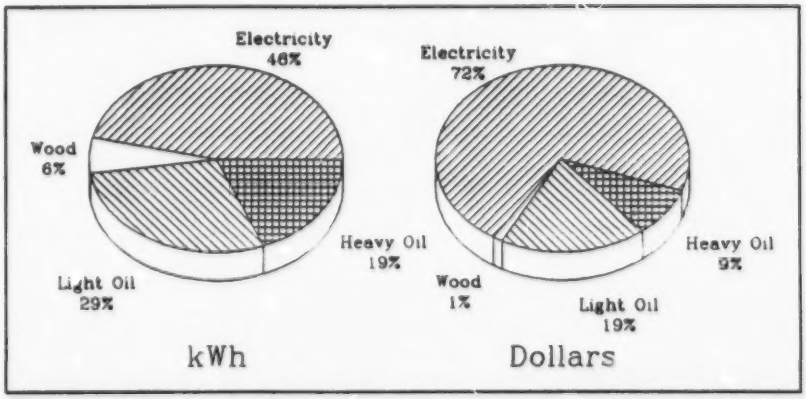

Figure 3.0 Fuel Use Patterns for Provincially Owned Buildings, Fiscal Year 87/88

In Figure 4.0 below it can be seen that there is quite a wide variation in the average unit energy cost among the departments. Health and Community Services has the lowest cost because of their extensive use of less expensive energy sources, primarily wood and oil. Tourism Recreation & Heritage has the highest cost because many of the sites are seasonal operations, that have low energy usage with a heavy reliance on electricity.

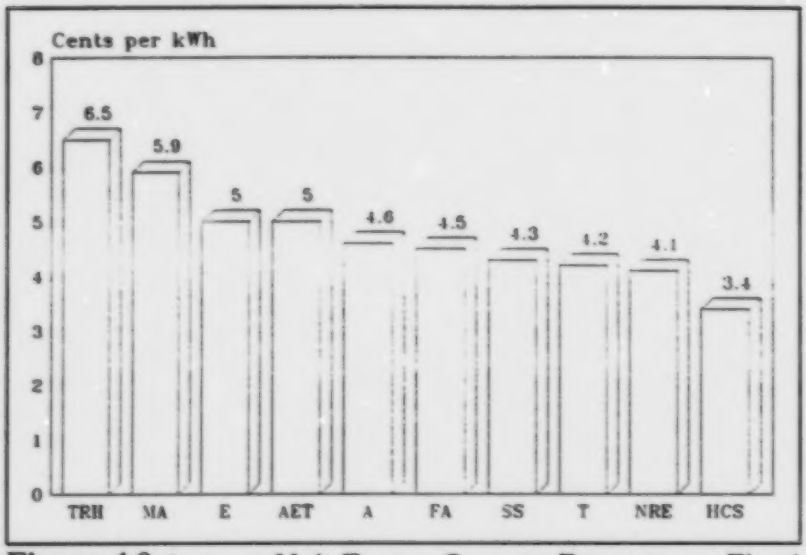

Figure 4.0 Average Unit Energy Cost per Department, Fiscal Year 87/88

With the convenience of electricity and its low initial cost there has been a recent trend to convert old buildings and provide new buildings with electric heat. It is important to emphasis that there are other fuel choices, which should be given consideration. Figure 5.0 on the next page illustrates the average costs of electricity, propane, light oil and heavy oil in provincial buildings. Although the high capital and extra maintenance costs of installing a heat source other than electricity may outweigh the savings of using another fuel, it is important to go through the analysis as other choices may prove to be attractive. The Energy Branch is more than willing to provide advice on fuel selections.

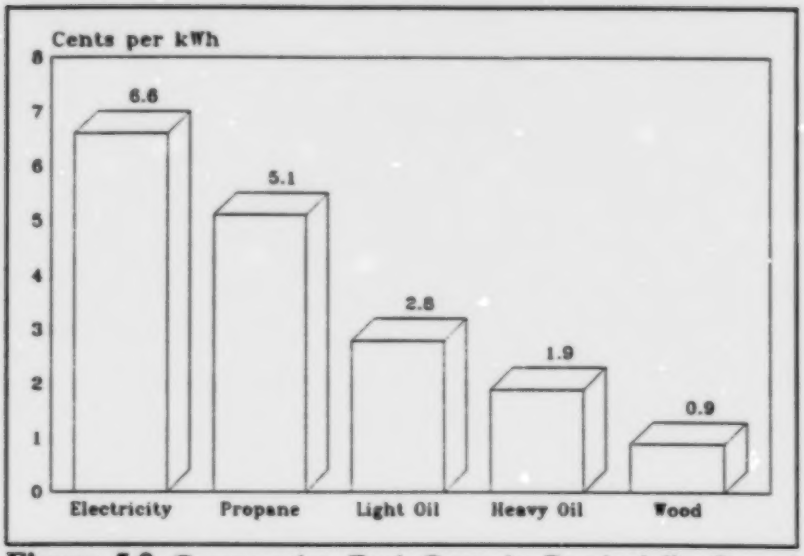

Figure 5.0 Comparative Fuel Costs in Provincially Owned Buildings, Fiscal Year 87/88

3.2 Program Benefits

With any management program it is important to set goals. From the information collected in the survey, the potential for annual energy savings can be estimated. In most cases the estimation is done on a site specific basis by comparing the kWh/ft^2 of the building in question with the kWh/ft^2 of a similar energy efficient building. Multipliers are then applied to account for rates of implementation. The resultant potential saving represents opportunities that are not capital intensive, i.e. low cost no cost measures. The total achievable annual saving for all departments is 28.5 million kWh, which, is equivalent to 1.1 million dollars. These numbers can be considered to be short term goals. **A long term goal for all departments is set at 3.7 million dollars which is equivalent to 95 million kWh.**

Besides the above noted amounts there are considerable dollar savings that are not directly associated with kWh savings. These include electric rate code changes, electronic billing with N.B. Power, and central tendering of light and heavy oils.

With the existing tendering procedure there is a significant variation in the price of light oil among departments. If all departments tendered as a unit, the shear purchase volume would result in a lower average price. Based on the data collected

for F.Y. 87/88 the average price paid for light oil is 20.52 cents per litre. In the same year Supply and Services paid an average of 18.54 cents per litre. If the same price could be achieved by central tendering the annual saving would amount $600,000 dollars. The saving for following the same process for heavy oil would amount to $46,000.

Concerning electronic billing, N.B. Power has agreed to place buildings on a normalized account. Normalized billing results in the same electric bill every month with a year end adjustment. With this system payment could be automated thereby avoiding the monthly invoicing procedure. N.B. Power would, however, still provide monthly consumption information for each building through the transfer of a computer disk or tape. The savings are difficult to estimate but it appears obvious that a considerable amount of time, postage, and errors would be saved for both parties. Such a system has been put into effect as a test case for Supply and Services.

The monitoring of energy use eases the process of discovering billing errors. Rate code changes to date have accounted for retroactive payments amounting to $202,000 dollars with associated annual savings of $86,200. Buildings currently under review should generate an additional retroactive payment of approximately $100,000. Rate codes will continue to be checked in the future.

One area that has yet to be analyzed is fuel optimization. For example, buildings using both oil and electric for space heating would pay a penalty in the way of increased electrical demand charges. Sometimes it may be advantages to switch to all electric where there is no demand charge.

Concerning specific opportunities the Energy Branch is offering to provide assistance in the evaluation and implementation of an oil fired combustion efficiencies improvement program. Cursory estimates indicates an annual savings of at least $165,000.

The problem with most of these savings is that they usually result in a reduced budget. In this circumstance there is no real incentive for an individual to save energy, as there is no direct benefit other the pride of reducing government spending. It is recommended that a portion of all documented savings be held as a separate fund that could be used to implement some of the more capital intensive retrofit opportunities or to increase maintenance budgets.

4.0 Conclusion

Plans for fiscal year 90/91 include continued monitoring with reporting on energy consumption patterns over the period of April 87 to April 90. The Energy Audit Phase is scheduled to start this summer. Departments wishing to have normalized billing with N.B. Power will be integrated into the system. A review of the potential of central tendering of oil will also be completed.

The impacts of improved energy efficiency are all positive. The government is in a position to set an example for private sector facilities, to reduce emissions, to protect the public from sudden price increases, to increase maintenance and capital budgets, to create local jobs, to improve building comfort, and perhaps more importantly to save money. All of this can be accomplished cost effectively.

The goals that have been set in the course of this report are conservative and attainable. Our role in administering the **Provincial Energy Management Program** is to help achieve these goals in whatever way is possible. Our purpose for establishing a strong monitoring aspect is to document savings that are achieved so that hard cases can be made in attempts to free up capital money for further energy efficiency improvements.

APPENDIX

Conversion Factors and Assumptions

The following table is a list of the multipliers used to convert the common units of fuel measurements to kWh. For example 16 litres of light oil is equal to 118 kWh (16 x 7.397).

Table 1 Conversion Factors to Obtain kWh

Fuel Type	Unit of Measure	Multilplier
Electricity	kWh	1.000
Light Oil	litres	7.397
Heavy Oil	litres	8.118
Propane	litres	5.660
Wood Residue	dry tonnes	3570
Round Wood	cords	4200

Assumptions

Light Oil

1 gallon = 48.04 kWh
1 litre = 0.21997 gallons
kWh/litre = 48.04 kWh/gal. x 0.21997 gal/litre = 10.567359
assuming a average efficiency of 70%
kWh/litre of end use energy = 10.567359 x 0.70 = **7.397**

Heavy Oil

1 gallon = 52.724 kWh
kWh/litre = 52.724 kWh/gal x 0.21997 gal./litre = 11.597698
assuming a 70% efficiency
kWh/litre of end use energy = 11.597698 x 0.70 = **8.118**

Propane

1 gallon = 32.162 kWh
kWh/litre = 32.162 kWh/litre x 0.21997 gal./litre = 7.074675
assuming a 80% efficiency
kWh/litre of end use energy = 7.074675 x 0.80 = **5.66**

Round Wood

1 cord of 16" stacked round wood = 2.56 m^3

green tonnes/cord = 2.56 m^3 x 1.11 green tonnes/m^3 = 2.84

kWh/cord = 2.84 green tonnes/cord x 2960 kWh/green tonne
= 8410

assuming a 50% efficiency

kWh/cord of end use energy = 8410 kWh/cord x 0.50
= **4200**

Wood Residue

1 green tonne = 2960 kWh @ 42 % moisture content

1 dry tonne = 2960 / (1 - .42) = 5100 kWh

assuming a efficiency of 70%

kWh/dry tonne = 5100 x 0.70 = **3570**

Acronyms

The following is a list of the acronyms used in the report with their full meaning.

A	Department of Agriculture
AET	Department of Advanced Education & Training
E	Department of Education
FA	Department of Fisheries & Aquaculture
HCS	Department of Health & Community Services
MA	Department of Municipal Affairs
NRE	Department of Natural Resources & Energy
SS	Department of Supply and Services
TRH	Department of Tourism Recreation & Heritage